CAL LAB

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INSTRUCTIONS

for the
WESTON MODEL 80
ANALYZER
"Volt-Ohm-Milliammeter"

INSTRUCTIONS

FOR THE

WESTON MODEL 80 ANALYZER

" VOLT-OHM - MILLIAMMETER "

(PATENTS PENDING)

WESTON INSTRUMENTS, INC.
NEWARK NEW JERSEY, U.S.A.

F-3327 Printed in U.S.A.

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Figure 1. Model 80 Analyzer

GENERAL DESCRIPTION

GENERAL: The Model 80 is a modern bench analyzer designed for the greatest convenience and utility. It is housed in a shock resistant ABS plastic case and utilizes precision metal film and wire wound resistors for all but the higher voltage ranges. A high torque-to-weight meter movement with spring backed jewels is used for long term stability and resistance to shock.

A single knob handles all ranges, with the majority of the ranges brought out to two banana jacks marked VOLTS OHMS MA and COMMON -DC ±AC

The 10 AMPS DC, AC output, and higher voltage ranges are on separate jacks. The analyzer is provided with a polarity reversing switch. (See Figure 1.)

Ranges have been chosen to give the best coverage for measurements in the electric and electronic fields. A large scale is provided with a new and unique anti parallax arrangement which allows faster readings with less eye fatigue than with the conventional mirror scale.

ACCESSORIES:

1. Test Leads (spare set) - Weston Part No. ND 39900-001 and ND 39901-001. The black or common lead is provided with a crocodile clip, while the red lead has a test prod with a removable alligator clip.

2. Protective Leather Carrying Case - Weston Part/Drawing No. 250753.

RANGES: The Model 80 Analyzer has the following ranges:

DC VOLTS at 20,000 Ω/V	AC VOLTS at 5,000 Ω/V	OUTPUT db	DC CURRENT	OHMS FULL SCALE	OHMS CENTER SCALE
.25	2.5	-10 to +10	50μa	2,000	20
1	10	+2 to +22	1ma	20,000	200
2.5	50	+16 to +36	10ma	200,000	2,000
10	250	+30 to +50	100ma	2 Meg	20,000
25	500	+36 to +56	1000ma	20 Meg	200,000
50	1000		10amps		
100	5000				
250					
1000					
5000					

ACCURACY:

DC ranges ±1% of full scale
1 KV and 5 KV DC ranges ±2% of full scale
AC ranges ±1.5% of full scale
1 KV and 5 KV AC ranges ±2.5% of full scale
Ohm ranges approximately 1% of scale length.

TEMPERATURE ERROR: The Model 80 has exceptionally low temperature error since a negative temperature coefficient resistor compensates for the copper of the moving element and the majority of the resistors have a coefficient of 150 ppm/°C, or less. All DC ranges are within 0.5% for 10°C except the 1 and 5 KV ranges, using carbon film resistors, which are generally about 1% for 10°C.

The AC Voltage circuit has low temperature error because of germanium diodes specially selected for low reverse current and low forward resistance. The temperature error is generally less than 1% for 10°C, except for the 1 and 5 KV ranges which are closer to 1.5% for 10°C.

FREQUENCY ERROR: Figure 2 shows typical frequency error for the AC voltage ranges. The dotted lines show the cut-off of the output ranges because of the blocking condenser used.

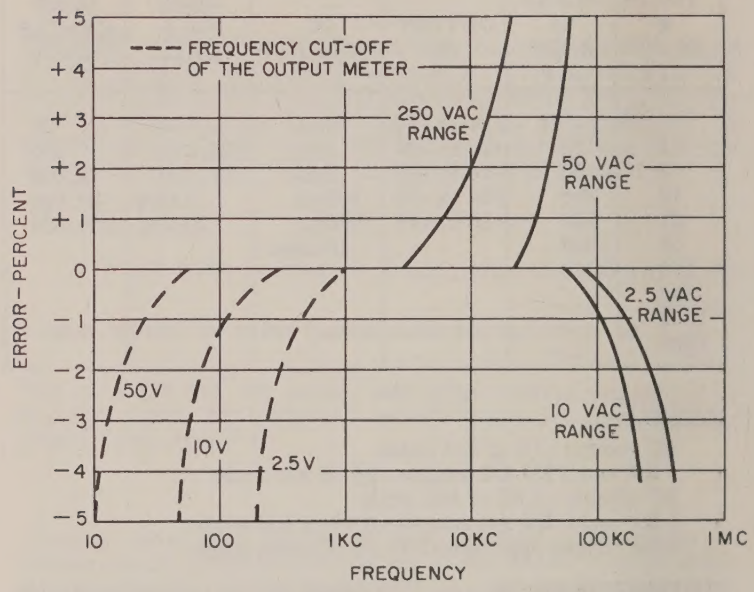

Figure 2. Typical Frequency Response

OVERLOAD PROTECTION: The meter is protected from overload by silicon rectifiers connected across the reversing switch. All ranges can withstand at least a momentary application of 115V across the input jacks with the exception of the current ranges. The two lower ohmmeter ranges, which are the most vulnerable to overload, are protected by a fuse.

OPERATING INSTRUCTIONS

ANTIPARALLAX DIAL: A plastic overlay is provided which splits the upper set of scale lines. The correct reading position is obtained when the section of any line under the overlay lines up with that part which is not covered. Select a line at about the same deflection at which the reading is to be taken. This method of parallax correction will be found much faster and less fatiguing than the conventional mirror scale and equally accurate.

REVERSING SWITCH: A reversing switch is located on the right side of the case well away from the electrical connections. To use the OHMS, AC VOLTS, and DC with the common post negative, place the switch in the down position. If a down scale reading is obtained on any DC range, place the switch in the up position, making the COMMON, -DC, ±AC jacks positive. It is not necessary to de-energize the meter when reversing polarity except as noted under HIGH VOLTAGE PRECAUTIONS. There are protective silicon diodes across the switch so that the circuit is not broken when the switch is used. The meter polarity is reversed, rather than the input connections, so that the meter will always be at low potential.

HIGH VOLTAGE PRECAUTIONS: In high voltage circuits, do not touch either the leads or the analyzer. Before making connections or changing the polarity, the circuit should always be de-energized.

The high potential jacks for the 5 KV range are located on the left side of the case well away from the user to minimize the hazard. With the common jack connected to the low potential or ground of the circuit under test, the meter will always be at low potential.

DC VOLTAGE MEASUREMENTS TO 250 V:

1. Rotate SWITCH to desired DC voltage range.
2. Plug BLACK test lead in COMMON, -DC, ±AC jack and connect clip to low potential circuit point.
3. Plug RED test lead in VOLTS-OHMS-MA jack.

CAUTION: If voltage to be measured is unknown, start at 250 V range and work down.

4. Read DC voltage on DC arc.

Switch Setting	Scale Used	Switch Setting	Scale Used
.25 V	250 ÷ 1000	25 V	250 ÷ 10
1 V	10 ÷ 10	50 V	50
2.5 V	250 ÷ 100	100 V	10 x 10
10 V	10	250 V	250

DC VOLTAGE ABOVE 250 V:

1. Rotate SWITCH to 250 V DC position.
2. Plug BLACK test lead in COMMON, -DC, ±AC jack and connect clip to ground or low potential circuit point.
3. Plug RED test lead in 5KV DC or 1KV DC RED jack.
4. Read DC voltage on DC arc.

Range	Scale Used
1000 V	10 x 100
5000 V	50 x 100

CAUTION: Clip the RED test lead into the circuit being tested before it is energized. See HIGH VOLTAGE PRECAUTIONS.

AC VOLTAGE MEASUREMENTS TO 500 V:

1. Rotate SWITCH to desired AC voltage range.
2. Plug BLACK test lead in COMMON, -DC, ±AC jack and connect clip to low potential circuit point.
3. Plug RED test lead in VOLTS-OHMS-MA jack.

CAUTION: If voltage to be measured is unknown, start at 500 V range and work down.

4. Read AC voltage less than 2.5 VAC directly on the lower AC arc. Read AC voltage above 2.5 VAC on the upper arc.

Switch Setting	Scale Used
2.5	2.5 VAC
10	10
50	50
250	250
500	50 x 10

AC VOLTAGE ABOVE 500 V:

1. Rotate SWITCH to 500 VAC position.
2. Plug BLACK test lead in COMMON, -DC, ±AC jack and connect clip to ground or low potential circuit point.
3. Plug RED test lead in 5 KV AC or 1 KV BLACK jack.
4. Read AC voltage on upper AC arc.

Range	Scale Used
1000 V	10 x 1000
5000 V	50 x 100

CAUTION: Clip the RED test lead into the circuit being tested before it is energized. See HIGH VOLTAGE PRECAUTIONS.

DC CURRENT MEASUREMENTS TO 1000 MA:

1. Rotate SWITCH to desired current range.
2. Plug BLACK test lead in COMMON, -DC, ±AC jack.
3. Plug RED test lead in VOLTS-OHMS-MA jack.

CAUTION: Always start with switch in 1000 MA position and work down.

4. Read DC current on DC arc.

Switch Setting	Scale Used
50 μA	50
1 MA	10 ÷ 10
10 MA	10
100 MA	10 x 10
1000 MA	10 x 100

DC CURRENT MEASUREMENTS ABOVE 1000, MA:

1. Rotate SWITCH to 100 MA position.
2. Plug BLACK test lead in COMMON, -DC, ±AC jack.
3. Plug RED test lead in 10 AMPS jack.
4. Read DC current on DC arc.

Switch Setting	Scale Used
100 MA	10

RESISTANCE MEASUREMENTS

CAUTION: Make sure all voltage is turned off before connecting the analyzer to the device being checked.

1. Plug BLACK test lead in COMMON, -DC, ±AC jack.
2. Plug RED test lead in VOLTS-OHMS-MA jack.
3. Rotate SWITCH to desired ohmmeter range.
4. Short test leads together and set pointer to top scale position by rotating OHMS ADJ.
5. Read resistance on OHMS arc.

Switch Setting	Multiply Readings By
R x 1	1
R x 10	10
R x 100	100
R x 1000	1000
R x 10,000	10,000

OUTPUT METER MEASURMENTS

NOTE: Zero power level is based on 1 milliwatt in a 600 ohm line.

1. Plug BLACK test lead in COMMON, -DC, ±AC jack.
2. Plug RED test lead in OUTPUT jack.
3. Rotate SWITCH to desired range as listed in Step 4.
4. Read db on arc marked -10 to +10 db.

Switch Setting	db Range	Add to Reading
2.5	-10 to +10	Use -10 to +10 arc
10	2 to +22	+12
50	+16 to +36	+26
250	+30 to +50	+40
500	+36 to +56	+46

NOTE: A 0.2 μf capacitor is connected internally to the OUTPUT jack to block out any DC that may be present. Also, when reading -10 to +10 db on the 2.5 volt range, the 0 db mark is high due to the AC characteristic of the range. For correction, add 1 db to the reading.

DATA ON DB LEVELS

Power Level DB	6 MW in 500 Ohms	Volts, based on 0 DB of 6 MW in 600 Ohms	Volts, based on 0 DB of 1 MW in 600 Ohms
-10	0.548	0.600	0.245
- 9	0.614	0.673	0.275
- 8	0.689	0.755	0.308
- 7	0.774	0.847	0.346
- 6	0.868	0.951	0.388
- 5	0.974	1.067	0.436
- 4	1.093	1.197	0.489
- 3	1.226	1.343	0.548
- 2	1.376	1.507	0.615
- 1	1.544	1.691	0.690
0	1.732	1.897	0.775
+ 1	1.943	2.129	0.869
+ 2	2.180	2.389	0.975
+ 3	2.447	2.680	1.094
+ 4	2.745	3.007	1.228
+ 5	3.080	3.374	1.377
+ 6	3.456	3.787	1.545
+ 7	3.878	4.248	1.734
+ 8	4.351	4.766	1.946
+ 9	4.882	5.347	2.183
+10	5.477	6.000	2.449
+11	6.145	6.732	2.748
+12	6.895	7.554	3.084
+13	7.737	8.475	3.460
+14	8.681	9.509	3.882
+15	9.740	10.67	4.356
+16	10.93	11.97	4.887
+17	12.26	13.43	5.484
+18	13.76	15.07	6.153
+19	15.44	16 91	6.904
+20	17.32	18.97	7.746
+21	19.43	21.29	8.691
+22	21.80	23.89	9.752
+23	24.47	26.80	10.94

DATA ON DB LEVELS (Continued)

Power Level DB	6 MW in 500 Ohms	Volts, based on 0 DB of 6 MW in 600 Ohms	1 MW in 600 Ohms
+24	27.45	30.07	12.28
+25	30.80	33.74	13.77
+26	34.56	37.87	15.45
+27	38.78	42.48	17.34
+28	43.51	47.66	19.46
+29	48.82	53.48	21.83
+30	54.77	60.00	24.49
+31	61.45	67.32	27.48
+32	68.95	75.54	30.84
+33	77.37	84.75	34.60
+34	86.81	95.09	38.82
+35	97.40	106.70	43.56
+36	109.3	119.7	48.87
+37	122.6	134.3	54.84
+38	137.6	150.7	61.53
+39	154.4	169.1	69.04
+40	173.2	189.7	77.46
+41	194.3	212.9	86.91
+42	218.0	238.9	97.51
+43	244.7	268.0	109.4
+44	274.5	300.7	122.8
+45	308.0	337.4	137.7
+46	345.6	378.7	154.6
+47	387.8	424.8	173.4
+48	435.1	476.6	194.6
+49	488.2	534.7	218.3
+50	547.7	600.0	245.0

THEORY OF OPERATION

DC VOLTS: All DC voltage ranges operate with a sensitivity of 20,000 ohms per volt. The circuit is shown in Figure 3. A negative temperature coefficient resistor R39 is used to compensate the 0.25 V range. As the range is changed, additional resistance is added in series to obtain the necessary full scale deflection.

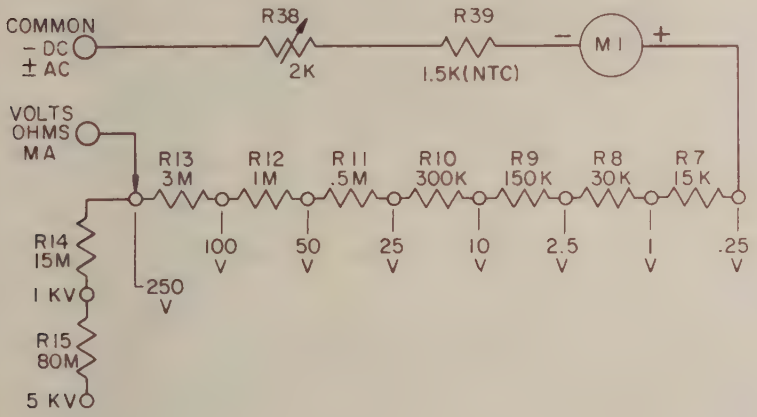

Figure 3. DC Volts Circuit

AC VOLTS: All AC voltage ranges operate with a sensitivity of 5000 ohms per volt. The applied AC voltage is rectified by a full wave half bridge circuit using selected germanium diodes. A resistor in series with the meter adjusts the AC sensitivity to exactly 200 microamperes. As the range is changed, additional series resistance is added ahead of the rectifier to obtain full scale deflection as in Figure 4. The circuit is average responsive and is calibrated in rms of a true sine wave.

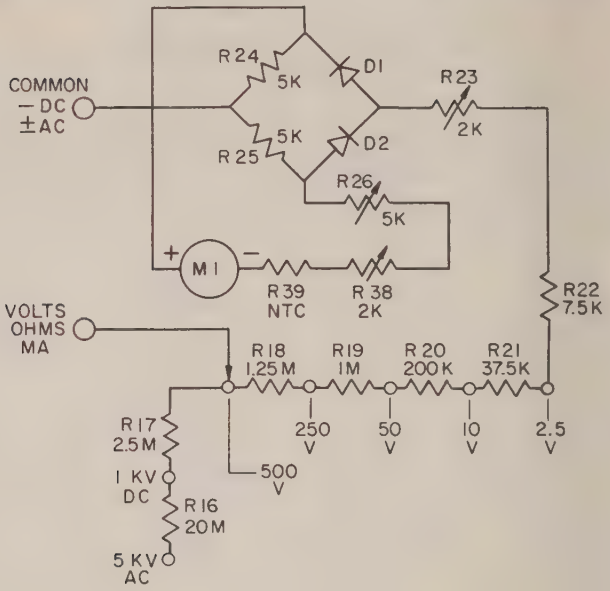

Figure 4. AC Volts Circuit

DC CURRENT RANGES : The operation of the milliampere ranges is shown in Figure 5. The potential drop of the meter circuit is 250 MV and the same adjustable resistor is used as for the 0.25 V range. A series shunt is used across the meter circuit. The current on any range divides inversely proportional to the total resistance in each branch of the parallel circuit. The 50 μA range is read on the 0.25 V range switch position.

OHMMETER RANGES: The ohmmeter ranges are of the series type illustrated in Figure 6. In the four lower ranges, current flows from the 1.5 volt battery through one of the sections of a series shunt, according to the range selected. It then returns through the unknown resistor R_X being measured and back to the battery. On the highest range more voltage is necessary; therefore, the 1.5 volt battery is replaced by a 15 volt battery. The ohmmeter adjuster and a series resistor are in shunt across the meter to compensate for changes in battery voltage.

OUTPUT RANGES: The output or db ranges operate on the same principle as the AC voltage ranges except that the readings are taken on a db arc. A condenser is placed in series with the OUTPUT jack to block out DC. Zero power level is based on 1 milliwatt in a 600 ohm line.

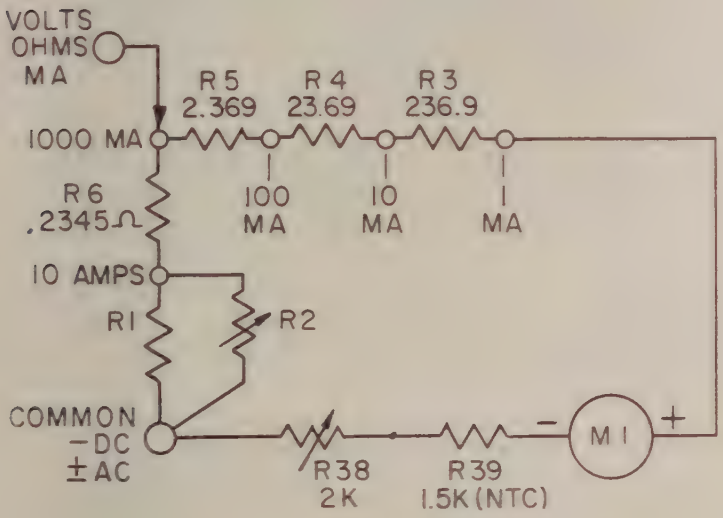

Figure 5. DC Current Circuit

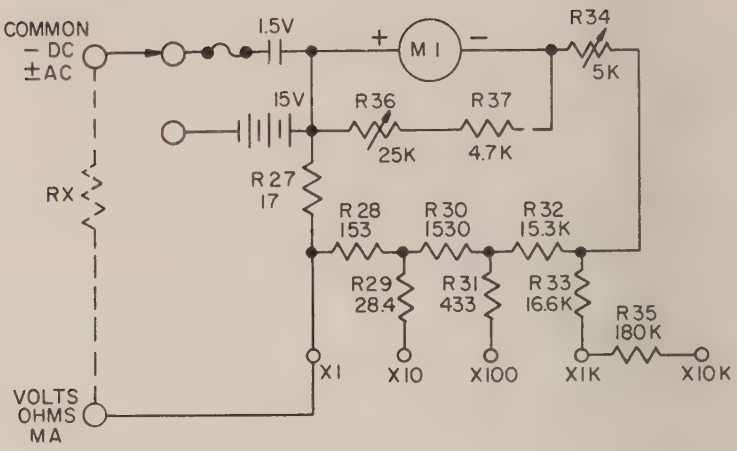

Figure 6. Ohmeter Circuit

MAINTENANCE

REPLACEMENT OF BATTERIES: The Model 80 has two batteries, a 1.5 volt battery for the four lowest ohmmeter ranges and a 15 volt battery for the highest ohmmeter range. When the instrument can no longer reach full scale deflection on any of the four lower ranges when the leads are shorted and the OHMS ADJ. control rotated, the 1.5 volt battery must be replaced. When the instrument can no longer reach full scale deflection on the R x 10,000 range when the leads are shorted and the OHMS ADJ control rotated, the 15 volt battery must be replaced.

To install or change a battery, it is only necessary to remove the back of the instrument, slip out the old battery and place a fresh one in its place. (See Figure 7.) The positive terminals are identified by the blue wire connection and the (+) marking on the battery holder.

CALIBRATION: The Model 80 is correctly adjusted at the factory, however, should readjustment ever become necessary, proceed as follows:

1. Remove back plate by removing two nuts on back of Analyzer and two screws on bottom of case.
2. Unsolder 5KV DC and AC jack connections.
3. Remove front panel and drop printed circuit board by removing two control knobs and four corner screws.
4. Remove two screws holding reversing switch.
5. Slide meter out of half-frame by removing two screws and brackets on either side. It is now possible to slide out the circuit and battery decks and the meter without detaching any of the connections.

DC ADJUSTMENTS:

1. Rotate SWITCH to 50 μA position.
2. Adjust MAGNETIC SHUNT under nut of (-) meter stud to obtain full scale deflection with exactly 50 μA applied to COMMON, -DC, ±AC and VOLTS-OHMS-MA jacks.
3. Apply exactly 250 MV to the same jacks and adjust control R 38 to obtain full scale deflection.

4. All DC voltage and current ranges should fall in line. An independent adjustment of the 10 ampere range can be made by adjusting the slide wire R2.
5. The ohmmeter circuit can be readily adjusted as follows:
   a. Rotate SWITCH to R x 1000 range.
   b. Short the leads and turn OHMS ADJ to obtain full scale deflection.
   c. Disconnect 1.5 V battery and short the battery connections.
   d. Connect leads to a Wheatstone Bridge and adjust R34 to obtain exactly 20,000 ohms.

AC ADJUSTMENTS:

1. Rotate SWITCH to 250 VAC.
2. Apply 250 VAC to the COMMON, -DC, ±AC and the VOLTS-OHMS-MA jacks.
3. Set POINTER on top mark by adjusting R26.
4. Apply 2.5 VAC and rotate SWITCH to 2.5 VAC.
5. Set POINTER on top mark by adjusting R23.
6. Recheck top mark on 250 VAC range.

CLEANING PROCEDURE FOR THERMOPLASTIC METER WINDOW: Clean plastic meter window with obsorbent cotton dipped in a solution made by dissolving 1/2 teaspoon of detergent, such as Vel or Dreft, in one gallon of water. Lightly wipe over window and allow solution to air dry. DO NOT WIPE DRY.

If static charges occur, Weston Statnul® SND 28394-001 is recommended. The proper method of application is indicated on the Statnul container.

COMPONENTS: The resistors up to and including 1.25 megohms are either precision metal film or wire wound types. The higher values are carbon film resistors. If for any reason a component on the printed circuit board becomes damaged, it may easily be replaced by clipping off the damaged component so as to leave the leads protruding above the plate. When this is done, the replacement component may be soldered directly to these leads.

FUSE REPLACEMENT: A 1/4 amp fuse is provided to protect the ohmmeter circuit from severe overloads. Failure of the meter to operate on the R x 1, R x 10, and R x 100 ohmmeter ranges is an indication that the fuse has blown. Fuse replacement is easily made by removing the old one from the fuse clip and replacing it with a new 1/4 amp 250 V Littlefuse type 8AG. If a fuse made by another manufacturer is used, make sure that its cold resistance measures 2.7 ohms, otherwise inaccurate readings will be obtained.

REPLACEMENT PARTS LIST FOR MODEL 80

Circuit Symbol	Description	Weston Part No.
C1	CAPACITOR, PAPER, MOLDED: .2uf 400 WVDC	ND39704-001
D1, 2	RECTIFIER, GERMANIUM:	ND39705-001
D3, 4	DIODE, SILICON:	ND39899-001
E1	KNOB: OHMS ADJ., black bakelite	ND39697-001
E2	KNOB: function and range switch, black bakelite	ND39687-001
E3	CLIP, ALLIGATOR: Used with red prod	ND39962-045
F1	FUSE: .25 amp; 250 V, littlefuse 8AG	ND29787-001
M1	METER ASSEMBLY:	249853-901
R1	SHUNT, INSTRUMENT: (0.0263 ohms ±1/2%)	249850-901
R2	SHUNT, INSTRUMENT ADJUSTING: (0.0263 ohms ±1/2%)	249852-001
R3	RESISTOR, FIXED, METAL FILM: 236.9 ohms, ±1/2%, 1/2 watt	ND39718-001
R4	RESISTOR, FIXED, METAL FILM: 23.69 ohms, ±1/2%, 1/2 watt	ND39719-001
R5	RESISTOR, FIXED, WIRE WOUND: 2.369 ohms, ±1/2%, 1/3 watt	ND39710-001
R6	RESISTOR, FIXED, WIRE WOUND: .2345 ohms, ±1/2%, 1/2 watt	ND39709-001
R7	RESISTOR, FIXED, METAL FILM: 15K ohms, ±1/2%, 1/2 watt	ND39720-001
R8	RESISTOR, FIXED, METAL FILM: 30K ohms, ±1/2%, 1/2 watt	ND39721-001

Circuit Symbol	Description	Weston Part No.
R9	RESISTOR, FIXED, METAL FILM: 150K ohms, ±1/2%, 1/2 watt	ND39722-001
R10	RESISTOR, FIXED, METAL FILM: 300K ohms, ±1/2%, 1/2 watt	ND39723-001
R11	RESISTOR, FIXED, METAL FILM: 500K ohms, ±1/2%, 1/2 watt	ND39724-001
R12, 19	RESISTOR, FIXED, METAL FILM: 1 megohm, ±1/2%, 1/2 watt	ND39725-001
R13	RESISTOR, FIXED, CARBON FILM: 3 megohms, 1/2%, 1 watt	ND39715-001
R14	RESISTOR, FIXED, CARBON FILM: 15 megohms, ±1%, 2 watt	ND39711-001
R15	RESISTOR, FIXED, CARBON FILM: 80 megohms, ±1%, 2 watt	ND39712-001
R16	RESISTOR, FIXED, CARBON FILM: 20 megohms, ±1% 2 watt	ND39713-001
R17	RESISTOR, FIXED, METAL FILM: 2.5 megohms, ±1%, 2 watt	ND39714-001
R18	RESISTOR, FIXED, METAL FILM: 1.25 megohms, ±1/2%, 1/2 watt	ND39726-001
R20	RESISTOR, FIXED, METAL FILM: 200K ohms, ±1/2%, 1/2 watt	ND39727-001
R21	RESISTOR, FIXED, METAL FILM: 37.5K ohms, ±1/2% 1/2 watt	ND39728-001
R22	RESISTOR, FIXED, METAL FILM: 7.5K ohms, ±1% 1/2 watt	ND39717-001
R22, 38	RESISTOR, VARIABLE WIRE WOUND: 2K ohms, ±20%, 2 watt	ND39707-001
R24, 25	RESISTOR, FIXED, METAL FILM: 5K ohms, ±1% 1/2 watt	ND39716-001
R26, 34	RESISTOR, VARIABLE, WIRE WOUND: 5K ohms, ±20%, 2 watt	ND39708-001

Circuit Symbol	Description	Weston Part No.
R27	RESISTOR, FIXED, METAL FILM: 17 ohms ±1/2%, 1/2 watt	ND39729-001
R28	RESISTOR, FIXED, METAL FILM: 153 ohms ±1/2%, 1/2 watt	ND39730-001
R29	RESISTOR, FIXED, METAL FILM: 28.4 ohms ±1/2% 1/2 watt	ND39731-001
R30	RESISTOR, FIXED, METAL FILM: 1530 ohms ±1/2%, 1/2 watt	ND39732-001
R31	RESISTOR, FIXED, METAL FILM: 433 ohms ±1/2%, 1/2 watt	ND39733-001
R32	RESISTOR, FIXED, METAL FILM: 15.3K ohms ±1/2%, 1/2 watt	ND39734-001
R33	RESISTOR, FIXED, METAL FILM: 16.6K ohms ±1/2%, 1/2 watt	ND39735-001
R35	RESISTOR, FIXED, METAL FILM: 180K ohms ±1/2%, 1/2 watt	ND39736-001
R36	RESISTOR, VARIABLE, CARBON: 25K ohms, ±20%, 1/2 watt	ND39700-001
R37	RESISTOR, FIXED, COMPOSITION: 4.7K ohms, ±10%, 1/2 watt	ND27605-001
R39	RESISTOR, NEGATIVE TEMP. COEFF: 1500 ohms, ±10%, 1/2 watt	ND39706-001
S1	SWITCH: function and range	249855-001
S2	SWITCH: reversing	ND39879-001
W1	LEAD, TEST: Assembled; red cable	ND39901-001
W2	LEAD, TEST: Assembled; black cable	ND39900-001
BT1	BATTERY: 15 volt; Eveready no. 411, or equivalent	ND39712-001
BT2	BATTERY: 1-1/2 volt; Ray-O-Vac no. 2LP Size "D" leakproof, or equivalent	ND19637-001

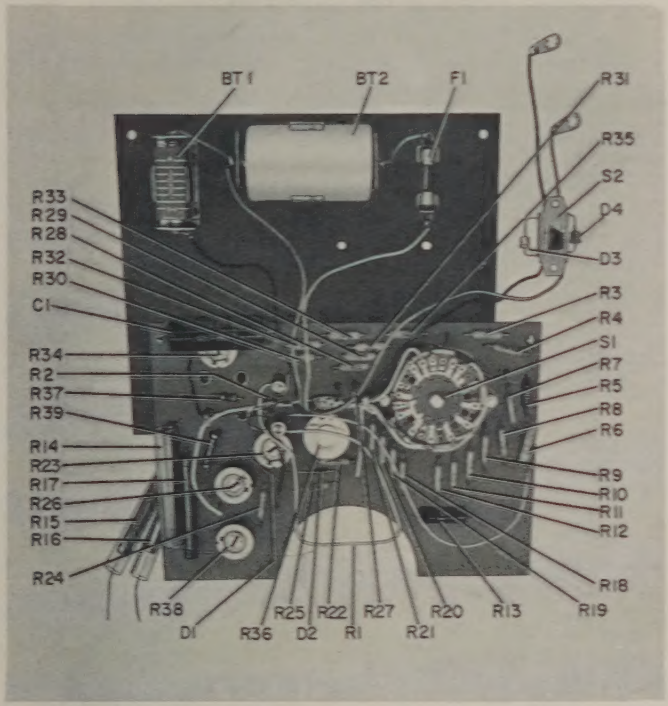

Figure 7. Internal View, Model 80

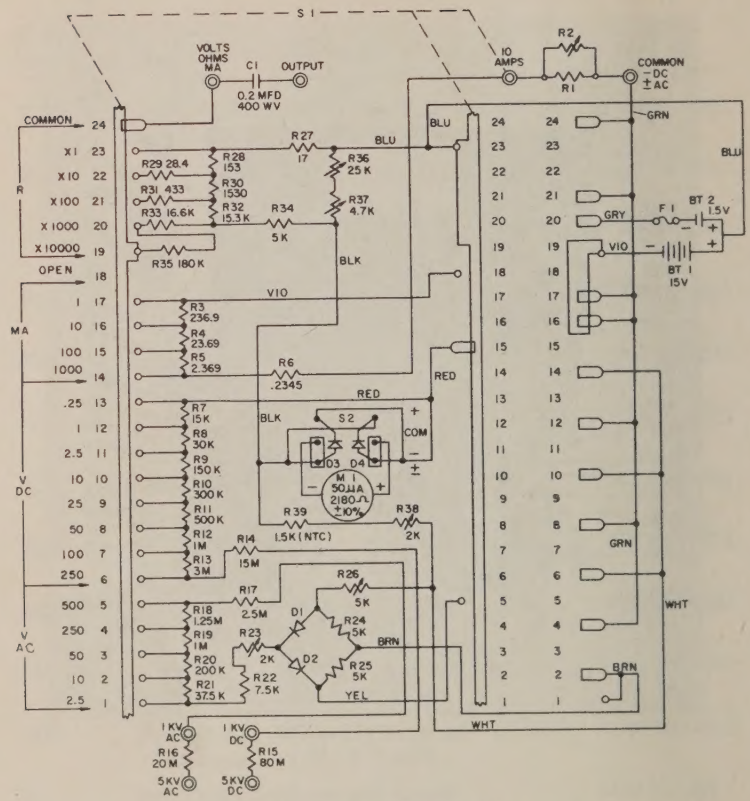

Figure 8. Schematic Diagram

THE WESTON 80 SERIES

MODEL 80 - ANALYZER
- Volt -Ohm- Millammeter

MODEL 81 - DC Multirange VOLTMETER
- DC Multirange AMMETER
- DC Multirange MILLIAMMETER

MODEL 82 - AC Multirange VOLTMETER
- AC Multirange AMMETER

MP MASTER
MA35468

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